tures in the two screens are identical, but the range of temperature in the small screen is 1.7° larger; that is to say, its maximum temperatures are 0.9° too high and its minimum temperatures 0.9 too low. Consequently, the larger screen is adopted as the standard. It is a single-louvred wooden screen, whose dimensions are 8 by 8 by 8 feet. This is about the size of the double-louvred screen used by the Weather Bureau at Washington, D. C., in 1870–1881, but afterwards replaced, in 1885, by the single-louvred screen, 3 by 3 by 3 feet.

As climatological studies of different parts of the world are very much affected by differences in the exposure of instruments and the methods of treating their indications, we need only call attention to the fact that Mr. Sutton deduces the dew-points from the readings of the wet and dry bulb by the use of Glaisher's Greenwich factors, a process that seems to us inappropriate to his dry climate, and by which he must, necessarily, lose much of the accuracy attainable in consideration of the great care that he has taken to give his wet and dry bulbs the proper exposure and treatment. However, he expresses the hope that he will be able to make a series of comparative observations of the dew-point with a Dine's hygrometer. As this has already been done by many others, he will doubtless be led to the same results as they, for there can be no doubt but what the ventilated psychrometer, either whirled or aspirated, is the only instrument comparable with the dew-point apparatus for convenience and accuracy.

We are much interested to notice that Mr. Sutton's experience is not favorable to the minimum thermometer exposed on the grass. In fact, this has long since been discarded by physicists as a means of indicating the intensity of sunshine, and can have little or no definite relation to the temperature of the grass. If solar radiation is to be measured, either absolutely or relatively, one must use the dynamic, and not the static, method. It matters not whether we use a black bulb *in vacuo* or the pyrheliometer of Pouillet, or that of Crova, or Violle, or Angström, or Chwolson, in every case the details of the apparatus are no more important than the method of using it, which must always be by alternate shading and exposing of about one minute each, or even less, and reduction by the proper formula. The only apparent exception to this rule is the newest electric pyrheliometer of Angström, but this is really for comparative, not absolute measurements.

Mr. Sutton admirably sums up the relative merits of the Campbell-Stokes burning recorder and the Jordan photographic recorder as used for the purpose of continuous register of the simple clearness and cloudiness of the sky. It would seem that the honors are about equally divided, and we would suggest that Professor Marvin's thermometric sunshine recorder be set up beside the other two, in the dry hot climate of Kenilworth.

Hydraulic engineers will be glad to avail themselves of the observations by Mr. Sutton on the subject of evaporation and its relation to rainfall. He has 6 rain gages within an area of 400 square miles, and says that it frequently happens that an inch or more of rain falls at one station without any rain at the others. The actual rain that falls into the tank is given for every hour of the year, as also the monthly totals of evaporation. The record was kept continuously by the auxanometer, constructed by the Cambridge Scientific Instrument Company. Observations were also taken regularly with the Piche evaporometer and the Pickering evaporator.

The approximate location of the Kenilworth observatory is, longitude, 24° 27′ E.; latitude, 28° 42′ S.; altitude, about 3,950 feet.

FROST WORK IN SOUTH AFRICA.

Among the interesting notes relating to rare meteorological phenomena in South Africa, we quote the following from the Annual Report for 1898, page 136:

An interesting phenomenon, apparently rare in South Africa, was observed during August, 1896, at Qachas Nek, in Basutoland, and reported by the assistant commissioner, H. R. Cartwright, to whom I am indebted for the following particulars, as well as for photographs of the same. Mr. Cartwright writes:

"I inclose a photo of some Japanese privet bushes covered with ice caused by a hard frost combined with a mist on August 5 last. The hedge was 10 feet high naturally, but by the spade standing alongside you will note that the height is less than half that amount, owing to the weight of ice on the branches. The natives here say they have never seen such an occurrence before, though I seem to recollect it in England. Owing to the fog being very thick at the time I took the photo, it is not as clear as could be wished."

From his reply to a letter asking a number of questions on the subject, it appears that a smooth and transparent coating of ice, about three-fourths of an inch thick, was deposited only on the windward (southeast) side of trees, branches, posts, etc., but none on the ground. There was no fall of hail, sleet, or snow, either before or after the occurrence. No definite time could be given for its first appearance, but there was no icy deposit at dusk on the 5th. Fog prevailed all day on the 5th, all that night, and up to 6 p. m. on the 6th. The deposit was first seen at 8 a. m. on August 6, and it began to thaw and drop off about 10 a. m. The privet bush was not broken, owing to its pliant branches, but several blue gums in the garden had about 5 or 6 feet of their tops broken off. The station is situated on the Drakensberg watershed, at an elevation of 7,150 feet, and faces almost due north. The readings, taken at 8 a. m. on the 6th, were: Dry bulb, 33°; wet bulb, 33°; minimum, 31°; rainfall (most probably a deposit from the fog or mist), 0.05 inch. One photograph shows the tall, slender branches bent completely over, so that their tops are touching the ground, and the other shows the bush in its natural condition from about the same point of view, the heights of the branches in both cases being contrasted with a spade 3 feet in length.

This phenomenon is comparatively common along the hedgerows in England, but is seen in much exaggerated form at high mountain stations, such as those on Mont Blanc and Ben Nevis, where the deposit, called fog crystals, is frequently 18 inches to 2 feet thick. It seems to be due to the watery particles of a drifting fog or mist being solidified into ice on coming into contact with a solid body.

On mountain tops this frostwork is a very common phenomenon, both in Europe and in the United States. Abundant illustrations of its occurrence on Mount Washington and Pikes Peak were published in the early days of the Weather Bureau, and similar cases have since then been noted on the summits of Säntis, Ben Nevis, and other mountains that have been occupied by meteorological stations; but certainly no one expected a case of this kind in Africa, in latitude 29° south, even at an elevation of 7,000 feet. The explanation above given is that which has been generally accepted, viz, that the moisture in the atmosphere has already condensed by the lowering of temperature into invisible small particles of ice or, possibly, spherules of water at a temperature below freezing; these, striking against any obstacle, accumulate on the windward side far more than on the leeward.

PROF. HENRY ALLEN HAZEN.

On the evening of Monday, January 22, 1900, Prof. Henry Allen Hazen, while riding rapidly on his bicycle, hastening to his night work at the Weather Bureau, collided with a pedestrian, and was dashed to the ground. After lying unconscious for twenty-four hours, he expired on the 23d.

Professor Hazen was born January 12, 1849, in Sirur, India, about 100 miles east of Bombay, the son of Rev. Allen Hazen, a missionary of the Congregational Church. He came to this country when ten years old and was educated at St. Johnsbury, Vt., and at Dartmouth College, where he was graduated in 1871. After this he removed to New Haven, Conn., and for four years subsequent was assistant in meteorology and physics under Prof. Elias Loomis. He was also privately associated with the latter in meteorological researches, and the preparation of many of the Contributions to Meteorology, published by Professor Loomis, some of which bear evidence of the reflex influence of the pupil on the teacher.

In the spring of 1881, when the present writer first saw

Professor Hazen in New Haven, the latter showed such an earnest interest in meteorology as to justify recommending him to the position of computer in the study room, which was then being organized by Gen. W. B. Hazen, the Chief Signal Officer, for the purpose of developing the scientific work of the Bureau, as a necessary adjunct to its important practical work. After his entry, May, 1881, into the meteorological work of the Signal Service, Professor Hazen took a prominent part in this field. The works specially assigned to him, such as the deduction of altitudes by railroad levels, the study of the psychrometer, the proper exposure of thermometers, the study of thunderstorms, annual courses of lectures on meteorology, were by no means sufficient to absorb his energies, and we find him writing and publishing on other subjects, such as barometric hypsometry and the reduction to sea level, the testing of anemometers, the study of tornadoes and the theories of cyclones, atmospheric electricity, balloon ascensions, the influence of sun spots and the moon, the danger lines of river floods, the sky glows and the eruption of Krakatoa. His enthusiastic advocacy of the importance of the balloon to meteorology was very highly appreciated. His five ascensions (1886, June 24–25, 1887, June 17 and August 13, 1892, October 27), undoubtedly gave very accurate temperatures and humidities. After the death of General Hazen, and during the administration of General Greely, the computers of the study room became junior professors at a higher salary, and were assigned to official duties of a broader aspect. In the course of such duties, Professor Hazen frequently took his turn as forecast official (beginning with October, 1887), and as Editor of the MONTHLY WEATHER REVIEW (beginning with December, 1888), while also acting as assistant in the Records Division. In July, 1891, in accordance with the terms of the transfer to the Department of Agriculture, he was appointed one of the professors of meteorology in the Weather Bureau, where he was at once assigned to regular and congenial duties in the Forecast Division.

Having shown that the Hazen thermometer shelter was much better than the large, close double-louvered one formerly used, his form was adopted by the Weather Bureau, in 1885, and still remains in use. His experimental work with the sling psychrometer and dew-point apparatus was executed with great care and refinement, but his resulting psychrometer formula differs from those in current use, in that he rejected the important term depending on the barometric pressure. Among his larger publications were: The Reduction of Air Pressure to Sea Level and The Climate of Chicago.

Professor Hazen was a frequent contributor to meteorological and other scientific journals. He was one of the supporters of Science during the years 1882–1889, and of the American Meteorological Journal, 1884–1896. He also published independently his Meteorological Tables and The Tornado, and possibly other works. A complete list of his published writings would include several hundred titles.

It must be confessed that a peculiar temperament sometimes led him to beliefs and statements in scientific matters entirely untenable at the present day, but to which he adhered with such pertinacity that to some he occasionally appeared obstinate and headstrong. This was simply a result of the intense earnestness of his own convictions which so completely absorbed his mind that there was no place for further considerations. However, the amiability of his character always prevented any enduring unpleasant feeling between himself and his associates.

In addition to his work in meteorology, Professor Hazen, like his master, Professor Loomis, was greatly devoted to the study of family history and genealogy, and it is understood that his collections in that line are in proper shape for the publication of a large volume. Certainly the wide-spread family to which he belonged includes very many distinguished names in theology, literature, commerce, and military matters. A great tenacity of purpose, independence of character, boldness in the defence of personal convictions and energy of execution are prominent characteristics of all the families bearing the name of our departed colleague. Himself unmarried, he cared lovingly and dutifully for relatives who depended on him. His heart was as many-sided as his intellect.

DEATH OF GEN. A. A. TILLO.

We regret to announce the death of Gen. A. A. Tillo at at St. Petersburg on January 11, 1900.[1]

General Tillo has, during the past twenty-five years, published numerous works, both large and small, on meteorological, magnetic, and other branches of terrestrial physics. We owe to him an extensive work on the distribution of atmospheric pressure over the entire Russian domain. He was vice president of the Russian Geographical Society, and his sudden death, at the age of 61, is a great loss to science.

WINTER KILLING OF FRUIT TREES.

In the November report of the Ohio section, Mr. J. Warren Smith communicates some of the replies to letters of inquiry sent out by him in order to collect statistics relative to the injury to fruit trees by cold winter weather. Mr. H. W. Gilbert, of Portage County, says:

I watched my peach trees pretty closely and did not discover any serious trouble until the cold spell in February. Then the cambium layer turned very brown and the wood was brown clear through and very brittle. The leaves, buds, and bark seemed bright, but the cambium was brown and grew darker all the way down until about a foot from the ground where the tree seemed to suffer the greatest damage. * * * I immediately cut 300 especially fine 3-year old trees off just above the snow line, leaving about 6 or 8 inches of bud wood that was apparently uninjured, thinking they would sprout, but they did not. * * * * I have just finished pulling up the roots and they are all bright, but not more than one-third had any sprouts on the roots.

In an orchard of 700 2-year old trees, I cut off about 100; they sprouted all right. The remainder of the orchard I cut back about the entire growth of the previous year and they have done finely; a few of the hardiest I left without trimming as an experiment, they look sickly and have made slender growth.

All trees that I have examined this fall have made but little new growth, but have deposited new wood of very uncommon thickness on the larger limbs and trunks, thus demonstrating that we can not determine by thickness of the layers of wood just how the trees have flourished during the year.

FARMERS' BULLETINS.

From a paragraph in the November report of the Mississippi section we infer that the Section Director, Mr. H. E. Wilkinson, has obtained from the Secretary of Agriculture a sufficient number of Farmers' Bulletin No. 89, On Cow Peas, to furnish a copy to each of the Weather Bureau crop correspondents and voluntary observers. This admirable arrangement is one that can be heartily recommended to all section directors. It is proper to add that if any section director can compile a short practical bulletin of from four to sixteen octavo pages on any subject of importance to the agriculturists of his State it will probably be acceptable to the Chief of the Weather Bureau and be recommended by him for publication as a farmers' bulletin.

[1] We assume that this is new style, as it has been widely stated that the new or European style of reckoning will be introduced, officially, into Russia during the present year.